(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 156 654**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 85302233.3

(22) Date of filing: 29.03.85

(51) Int. Cl.⁴: H 04 L 5/14
H 04 L 11/00

(30) Priority: 29.03.84 JP 59604/84

(43) Date of publication of application:
02.10.85 Bulletin 85/40

(84) Designated Contracting States:
CH DE FR GB LI

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(54) Control method for a half-duplex data transmission system.

(57) A data signal (7) of a data transmitting station (A) is output to another data transmitting station (B). A data signal (7) from the other station (B) is input to the first-mentioned station (A). Four statuses: transfer progression, transfer completion, reception allowance, and reception completion of each said data signal, are established depending upon signal levels and input/output timings of a single data control signal (8) which is output to the said other station (B) and a single data control signal (9) which is input from that station (B).

FIG. 3

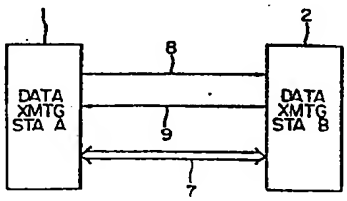
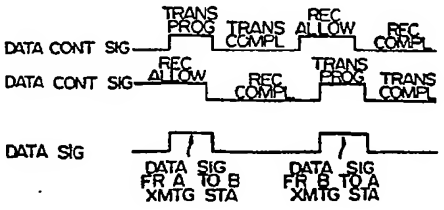


FIG. 4



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DATA TRANSMISSION APPARATUS

This invention relates to a data transmission apparatus wherein a data signal is output to another data transmitting station, while a data signal from the other data transmitting station is input.

Heretofore, as a data transmission system employing a data transmission apparatus of this type, one shown in Fig. 1 has been known. Referring to Fig.1, numeral 1 designates a data transmitting station A, numeral 2 a data transmitting station B, and numeral 3 a data transfer signal. By way of example, this signal indicates that data transfer from the data transmitting station A to the data transmitting station B is progressing, when its signal level is an H (high) level, and it indicates the completion of the data transfer when the level is an L (low) level. Numeral 4 designates a data reception signal, the H level of which indicates that data transmission from the data transmitting station A to the data transmitting station B is allowed or possible and the L level of which indicates that data reception has been completed. Likewise, numeral 5 denotes a data transfer signal from the data transmitting station B to the data transmitting station A, and numeral 6 a data reception signal from the data transmitting station B to the data transmitting

station A. Numeral 7 denotes data signals which are transferred and received in both the directions, and data can be exchanged between the data transmitting station A and the data transmitting station B.

Next, the operation of the prior-art apparatus shown in Fig. 1 will be explained with reference to a time chart in Fig. 2. The data transfer signal 3 which is output from the data transmitting station A indicates the status of transfer progression at the H level and the status of transfer completion at the L level as described before, and the data signal 7 is output from the data transmitting station A in only the transfer progression status. The data reception signal 6 which is output from the data transmitting station B indicates the allowance or possibility of reception at the H level and the completion of reception at the L level, and only when the data reception signal 6 from the data transmitting station B is at the H level and in the status of reception allowance, the data transmitting station A brings the data transfer signal 3 to the H level and falls into the status of transfer progression. Then, the data signal 7 is output from the data transmitting station A, and it is received by the data transmitting station B. When the data reception signal 6 which is output from the data transmitting station B has become

the L level to complete the reception, the data transfer signal 3 which is output from the data transmitting station A is consequently brought to the L level to complete the transfer. Therefore, the data signal 7 is no longer output from the data transmitting station A.

The data reception signal 4 output from the data transmitting station A and the data transfer signal 5 output from the data transmitting station B operate similarly to the data reception signal 6 and the data transfer signal 3, respectively. They are controlled by the corresponding data transmitting station A and B when the data signal 7 is output from the data transmitting station B to the data transmitting station A.

The prior-art apparatus which is constructed as shown in Fig. 1 and which is operated as illustrated in Fig. 2 has the disadvantage that the data transfer signals 3, 5 for signal transfer control and the data reception signals 4, 6 for signal reception control are required as data control signals, so two data control signals are needed per data transmitting station.

This invention eliminates the disadvantage of the prior art described above, and provides a data transmission apparatus wherein a data signal of a data transmitting station is output to another data transmitting station, and a data signal from the other data transmitting station is input to

the first-mentioned data transmitting station; characterized in that four statuses of transfer progression, transfer completion, reception allowance and reception completion of said each data signal are established depending upon signal levels and input/output timings of a single data control signal which is output to said other data transmitting station and a signal data control signal which is input from said other data transmitting station, with the result that data transmission is permitted using one data control signal per data transmitting station.

In the drawings:

Fig. 1 is a block diagram for explaining data transmission in prior art apparatus;

Fig. 2 is a timing chart of input and output signals in the apparatus shown in Fig. 1;

Fig. 3 is a block diagram showing an embodiment of this invention;

Fig. 4 is a timing chart of input and output signals in the apparatus shown in Fig. 3; and

Figs. 5 and 6 are block diagrams showing other embodiments different from each other.

In the drawings, the same symbols designate identical or corresponding portions.

Now, one embodiment of this invention will be described with reference to the drawings. Referring to Fig. 3, numeral 1 designates a data transmitting station A, numeral 2 a data transmitting station B, and numeral 7 data signals, and these are the same as explained by the use of the identical symbols with reference to Fig. 1. Numeral 8 designates a data control signal which is output from the data transmitting station A and is input to the data transmitting station B, while numeral 9 designates a data control signal which is output from the data transmitting station B and is input to the data transmitting station A. The data signal 7 is controlled by the data control signals 8, 9, and it is output from either one of the data transmitting stations A and B and is input to the other. In addition, this data signal 7 is composed of a plurality of serial or parallel bits constituting a digital signal or the like.

Next, the operation of the apparatus illustrated in Fig. 3 will be described by referring also to a timing chart in Fig. 4. By way of example, the data control signal 8 which is output from the data transmitting station A indicates the status of reception completion with its L level, while the data control signal 9 from the data transmitting station B indicates the status of reception allowance with its H level. The data signal

7 is output from neither of the data transmitting stations A and B. The data control signal 8 output from the data transmitting station A changes from the L level to the H level, thereby to fall into the status of transfer progression. At the same time, the data signal 7 is output from the data transmitting station A and is input to the data transmitting station B. The data transmitting station B receives the data signal 7 when the data control signal 8 in the transfer progression status from the data transmitting station A is at the H level, and the reception is completed in response to the change, from the H level to the L level, of the data control signal 9 which is output by the data transmitting station B. When this data control signal 9 has changed from the H level to the L level into the reception completion status, the data control signal 8 output from the data transmitting station A changes from the H level to the L level into the transfer completion status, and the data signal 7 fails to be output. Thereafter, the data control signal 8 changes from the L level to the H level again, thereby to fall into the status of reception allowance. Thus, the data control signal 9 of the data transmitting station B changes from the L level to the H level into the status of transfer progression, and the data signal 7 is output to the data transmitting

station A. Thenceforth, steps reverse to those of the foregoing output operation of the data signal 7 from the data transmitting station A to the data transmitting station B are repeated, and the data signal 7 can be sent in the opposite direction.

While the case of the arrangement of two data transmitting stations A and B has been illustrated in Figs. 3 and 4, this invention is also applicable to the case of three stations A, B, and C, arranged by adding the data transmitting station 10 as shown in Fig. 5 or Fig. 6. In this case, data control signals are required between the data transmitting stations A and B as represented by numerals 8 and 9 and between the data transmitting stations A and C as represented by symbols 8a and 9a. However, the data signals 7 may be made common as shown in Fig. 5 and can also be individually exchanged as shown in Fig. 6.

It is also possible to construct data transmission apparatus which copes with three or more data transmitting stations. In this case, the quantity of data of the data signals 7 to be sent in is determined beforehand, or which of transfer progression, transfer completion, reception allowance, or reception completion the data control signal 8, 9, 8a, or 9a to subsequently change indicates is altered at will, depending upon the content of the data signal 7 to be sent in, whereby the alternate exchange of the data signals 7 is changed.

As set forth above, according to this invention, data transmission apparatus wherein a data signal 7 is output to another data transmitting station B and wherein a data signal 7 from the other data transmitting station B is input is so constructed that four statuses: transfer progression, transfer completion, reception allowance, and reception completion, of the data signal 7, are established depending upon signal levels and input/output timings of a single data control signal 8 which is output to the other data transmitting station B and a single data control signal 9 which is input from the other data transmitting station B. This brings forth the effect that the apparatus of the invention can reduce the number of data control signals as compared with the prior-art apparatus, and the apparatus can accordingly be lowered in cost.

Claim:

1. Data transmission apparatus wherein a data signal (7) of a data transmitting station (A) is output to another data transmitting station (B), and a data signal (7) from the other data transmitting station (B) is input to the first-mentioned data transmitting station (A), characterized in that four statuses, viz. transfer progression, transfer completion, reception allowance, and reception completion of each said data signal, are established depending upon signal levels and input/output timings of a single data control signal (8) which is output to the said other data transmitting station (B) and a single data control signal (9) which is input from the said other data transmitting station (B).

FIG. 1

PRIOR ART

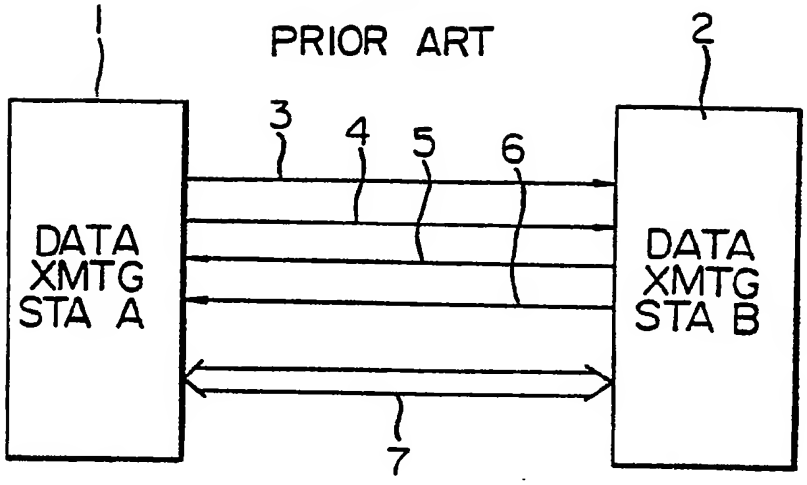

FIG. 2

PRIOR ART

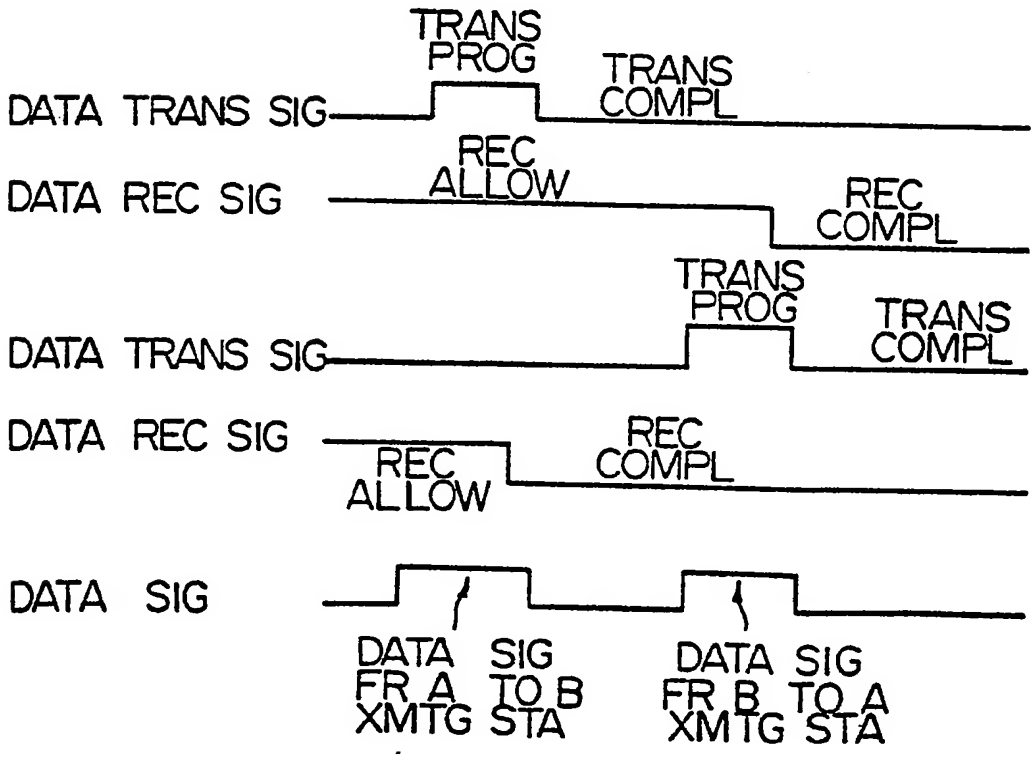

FIG. 3

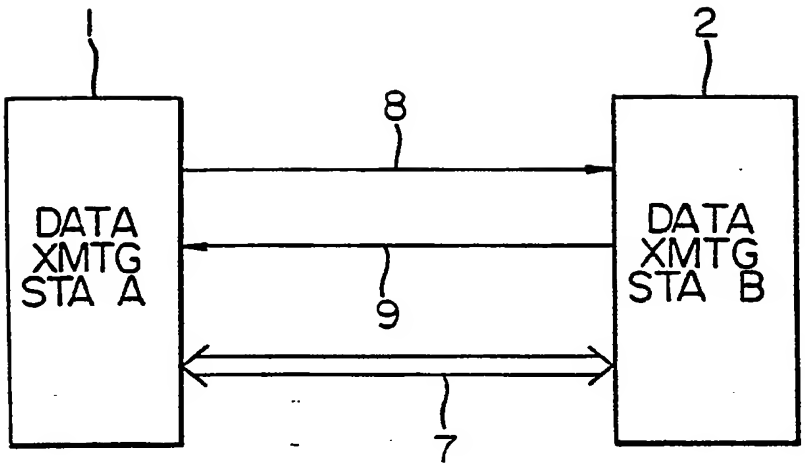

FIG. 4

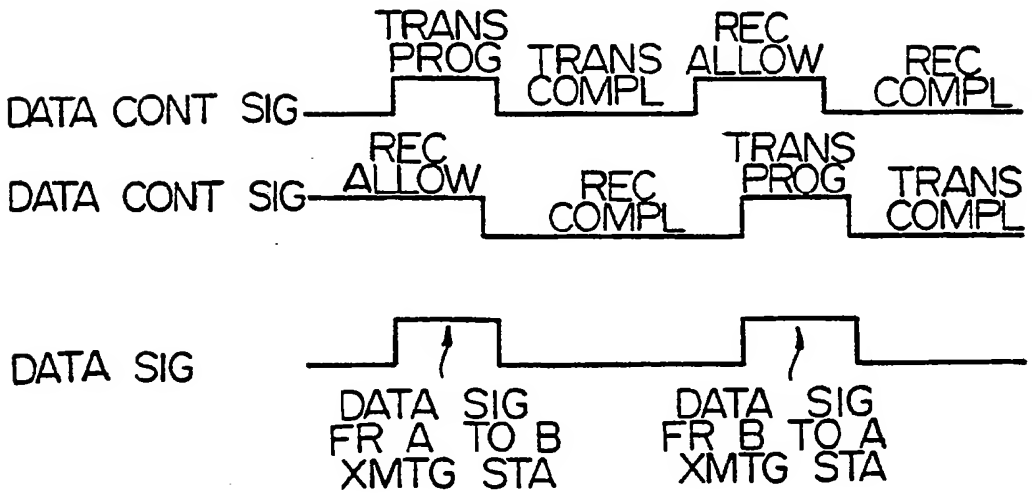

FIG. 5

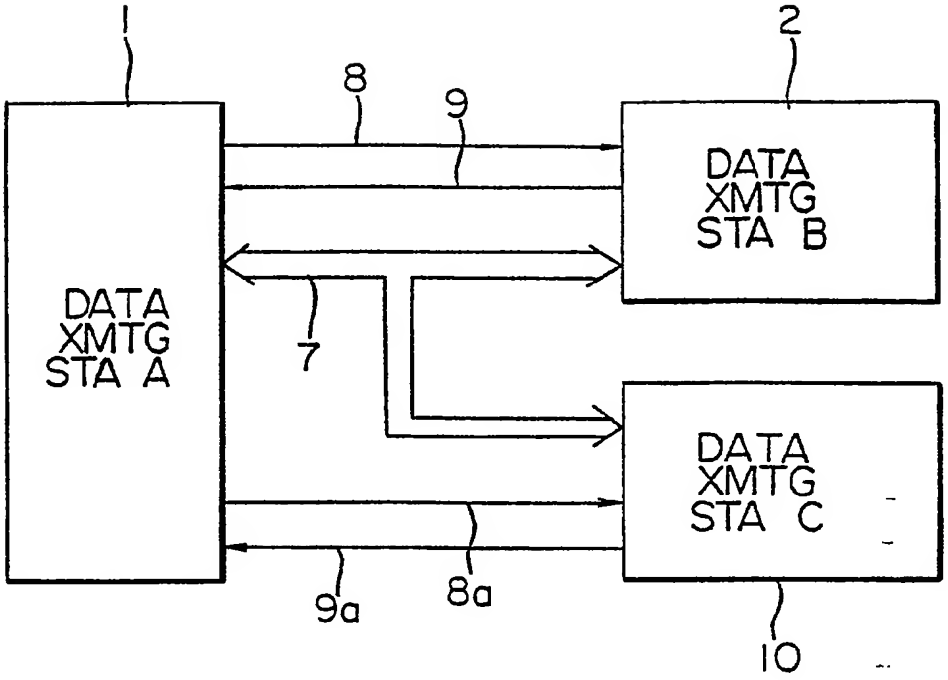

FIG. 6